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there any other day of the week, though the church bells are rung and numerous services are held nearly every day.

If on Sunday I go to the post-office, which is on the north-west corner of the street-crossing, where we usually turn south to the church, instead of going from there direct to the office as on other days, he turns to the south and goes to the church. He never willingly goes to the post-office on Sunday, but always stops there on week-days of his own accord, if permitted. Many times I have taken other streets on Sunday and approached the church from other directions; but in all cases, when left free, he invariably takes the first street leading to the church. I have experimented with him very largely in this respect, with a view to learning how he keeps the run of time, but am unable to satisfactorily account for it. I have also observed and experimented with him in a great many other ways, and have taught him to know the meaning of many words.

When alarmed at anything, he looks back to me with a frightened look, as much as to say, "Will it harm me?" On my saying to him, "All right, go on," he moves on. If much frightened, he will repeatedly look back for assurance from me.

He knows the meaning of many words, such as office, post-office, school-house, mill, farm, cemetery, church, apple, corn, grass, water, and many others. The fact that he knows the meaning of these words, or at least attaches a meaning to them, I have tested many times in many ways, the relation of which would make this paper too long. When his corn is about used up, if I speak of it to him and say, "Deck, your corn is out; you must go to the mill," even before starting from home, he turns in at the mill as I go by, and goes up to the office door where I have been in the habit of ordering his food. Sometimes I have forgotten it by the time I come opposite the mill, and would have gone by; but he has not forgotten it, and turns in. If I say to him, "Do you want an apple?" of which he is very fond, he puts on the most wistful look and does all in his power to say that he does; and if the apple is not produced at once, he begins to explore my pockets and clothing with his nose in search of an apple suspected to be concealed about my person. If I say to him, "Do you want grass?" he at once shows that he expects to be turned out upon pasture.

He also knows a number of people by name and where they reside; and if told to stop at the residence of one of them, naming him, he will do so, without any guiding.

These are only a few of the many evidences of his intelligence. Hundreds of examples might be given showing his knowledge and intelligence, and that he gives very close attention to and understands what is said to him.

Do not these facts strongly indicate that the horse has more than mere instinct, that he reasons; that out of the store-house of his knowledge and experience he forms conclusions, thoughts, purposes, and plans? He understands certain symbols, such as words; he keeps the run of time and knows uniformly when Sunday comes, for he has not made a mistake in this respect for more than twelve years past; he uses many and diverse means for making his wants known.

Instinct is supposed to imply inherited knowledge of objects and relations in respect to which it is exercised, and will usually, if not always, operate where there is no experience to guide. But this horse's knowledge, in these respects, has not been inherited, but is acquired. He never was at this church till he was six years old. His mother was probably never there. In instinct there is no necessary knowledge of means and ends implied, though such knowledge may be present, but instinct is always manifested in like manner by all individuals of the same species, under like circumstances, which is certainly not true in this case.

Hence I infer that this horse does reason; that he has a high degree of intelligence, even much more than he is able to make us understand and appreciate.

But does the fact of his observing Sunday imply a moral sense? Why does he seek to go to the church on that day? It has been said that animals do reasonable things without having the gift of reason; that they do things involving distant foresight without having any knowledge of the future; that they work for that which is to be without seeing or feeling anything beyond

what is; that they enjoy, but do not understand; that reason works upon and through them, but is not in them. The facts that I have related and observed make me greatly doubt many of these statements. I find it hard to sharply define the limits between instinct and reason. The facts that I have related indicate reason, intelligence, motives, and the formulation of plans, methods, and schemes for carrying out preconceived purposes. Some of the acts, at least, indicate pure reason based upon former and remembered sensations, perceptions, and knowledge, and the purpose to gratify merely mental desires.

What motive does this horse have for going to church every Sunday, even at a sacrifice sometimes? It is not for rest, it is not shelter, it is not feed, it is not company, it is not to gratify any merely physical want, for all these things he has elsewhere every day. Is it not purely an intellectual or moral want that he seeks to gratify? He stands near the church door, hears much of the exercises, especially the singing, and will remain, almost without motion, whether tied or not, till the services are over, and I am ready to go home. But it cannot be for the mere speaking and singing that he hears there, for he often hears speaking, singing, concerts, the Salvation Army, and music of various kinds while he stands tied at the office on the public square; but none of these take the place of his church-going.

These facts I have given as tending to illustrate and explain animal intelligence. I have given only such as I have verified many times.

T. B. REDDING.

Newcastle, Ind., Aug. 23.

The English Sparrow and our Native Birds.

I AM obliged to send a different report regarding the influence of the English sparrow on the presence of native wild birds in a country village.

In 1874-5 there were not more than one or two pairs of these foreigners in the village of Fort Edward. In less than ten years they numbered hundreds, and long since seemed to have reached the limit of the winter-food capacity of the district, being distributed among the farmers' barns as well as in the village.

Before their arrival the chipping sparrow was plentiful; now it is seldom seen. The song-sparrow nested frequently; I have not seen them in the village as residents for several years. Catbirds were not infrequent; now they come in the early spring for a few days, then disappear, though thickets on the river-bank near the town are especially favorable. Summer yellow-birds built often in the low trees; I have not seen a single resident this summer. Wilson's thrush also was an occasional resident; none have been here for four or five years. The vireo used to build and sing in the elms and apple-trees; they are very rare indeed now. The wood-phœbes, though their early morning song is still heard, are few in number where they were once abundant. The robin is almost the sole bird, in so far as I have observed, that holds his own regardless. I will except also the black martin, or house martin, who manages to turn out about four-fifths of the sparrows. The other fifth so blockade the entrance to the holes with their nests that the martin is effectually shut out. Bluebirds too have left us, they are too weak, and too refined in their tastes to long live neighbors to such low-lived little beasts as the filth-loving, quarrelsome, meddlesome sparrows.

I have a box in my garden which the sparrows do not dare to occupy, for they know me. But the bluebirds, who formerly nested there, come occasionally in the spring, have a tilt or two in the trees with the sparrows, then leave in disgust. Probably no native wild bird begins to have the mental development and quick wit possessed by the English sparrow. But all his wit runs to saving his precious self from danger and from exertion; hence he will, without doubt, persist. See, for example, how little strength he uses in avoiding danger. He just gets beyond range of whip or stone, and sits and calmly looks you over. He avoids poison with as much foresight as you could, and will starve rather than eat suspected food. He rolls in mud and dirt, oblivious of all else, just for the fun of having a lively squabble with some fellow, and when it is over is pecking about in the next ten seconds as if nothing had happened.

A half-dozen, or dozen, males chase down a female, roll her in the dust or mud as the case may be, and, despite the frantic fighting back, pull her tail, peck her wings, pinch her with their claws, and when the tormentors are tired out, and she panting with exhaustion, the whole party adjourn to a convenient heap of dung, and, in less time than it is spoken, the joke seems forgotten.

They drive away birds larger and more courageous than themselves, if they are perching birds, by following at their heels, and doubtless also making uncomplimentary remarks. Watch the arrival of the first robin, and see the three or four hoodlums follow him from tree to tree for the first week after his coming. Not one dares touch him, but they make his life miserable.

The song sparrow, though he will vanquish the Englishman every time, soon tires of being tagged from bush to tree, and leaves in disgust. The same is true of the catbird, and to some extent of the oriole, which is also less common by half. I have seen them pull a "chippy's" nest to pieces during the owner's absence out of pure mischief, and I presume they do the same to the nests of other birds.

It is difficult to see what there is to recommend the little villain, and the man who introduced him should be classed with the man who introduced rabbits into Australia.

X.

Port Edward, Aug. 22.

Celestial Photomicrography.

STELLAR photography has advanced enough to justify the hope that, by the next opposition of Mars, some means of scrutinizing his landscape more closely may be found. If microphotography and its associated science, photomicrography, are pushed on parallel lines with stellar photography by co-operating specialists who can appreciate the requirements in both fields, something valuable may result.

The possibility of an Atlantic cable was laughed at by good electricians, and astronomers despair of overcoming the difficulties presented by diffraction, irradiation, chromatic and atmospheric blurrings, and light absorption; but these matters have been conquered in many respects in telescopic and general photography.

Materials that will afford the densest homogeneity of surface should be sought for, upon which the photographs can be taken, to be later scrutinized with microscopic lenses. It may be possible to arrange a battery of microscopes to take enlarged *camera-lucida* photographs, which in turn may be enlarged by "solar prints;" and if surfaces can be invented or discovered smooth and continuous enough to admit of these successive enlargements without breaking up the details, we may possibly capture the Martial men in the act of filling Schiaparelli's canals, and otherwise observe what their estimated five million years of seniority over us affords them.

S. V. CLEVENGER.

Chicago, Aug. 21.

As to the "Extinction" of the American Horse.

IN 1881, in the *Kansas City Review*, E. L. Berthoud pointed out the fact that, in maps drawn up by Sebastian Cabot (who went in 1527 to the east coast of South America) to show his discoveries, at the head of La Plata, with figures of other animals he gives that of the horse.

This fact, as thus put on such indubitable record, is accepted by scientists, including Heilprin, Wilkins, and Flower. The latter, in his manual on "The Horse" (1891), says: "The usual statement as to the complete extinction of the horse in America is thus qualified, as there is a possibility of the animals having still existed, in a wild state, in some parts of the continent remote from that which was first visited by the Spaniards, where they were certainly unknown. It has been suggested that the horses which were found by Cabot in La Plata in 1530 cannot have been introduced."

The above is surely of great interest, and is worthy of repetition. The writer has come across two statements, which, taken in connection with the above, appear to be even more important and

significant, and may profitably be given wider prominence. As they are not generally known, they are given for the purpose of their receiving the attention that they seem to deserve.

In the volume of the Naturalist's Library, entitled "The Horse," by Major Hamilton-Smith, published in London in 1841, appears the following: "Several recent travellers in the northern portion of that continent [America] question the race of horses now so abundant being imported subsequent to the discovery by Columbus" (p. 147).

In "The History and Delineation of the Horse," by the noted authority, John Lawrence, published in London, 1809, the following sentence occurs: "The non-existence of the horse in America, previous to its discovery by Europeans, has, however, been disputed; but I recollect not by whom, or upon what ground" (p. 7).

ROBT. C. AULD.

Some Notes on The Rochester Meeting.

WHERE did the scientists come from? The first four hundred names on the register show their geographical distribution as follows, by States: New York, 119; Washington, D.C., 44; Ohio, 35; Pennsylvania, 24; Massachusetts, 22; Indiana, 19; Illinois, 18; Canada, 17; Connecticut, 13; Michigan, 11; Wisconsin, 10; Iowa, 10; New Jersey, 9; Missouri, 7; Maryland, 4; Kentucky, 4; Tennessee, 4; Alabama, 4; Maine, 3; Vermont, 3; California, 3; New Hampshire, Rhode Island, Minnesota, Georgia, and Florida, each 2; Virginia, West Virginia, North Carolina, Mississippi, Louisiana, and Texas, each 1.

More than one-fourth of the whole number came from New York State. Of the 119 from the State, 32 were from New York City and Brooklyn, 24 from Rochester, and 18 from Ithaca. Washington, D.C., furnished 44, the largest number from any one city. The whole of New England sent only 45, although it has until recently been considered the scientific headquarters of the country, and is more thickly dotted with colleges than any other section. Cornell University was more largely represented than any other University, while Princeton was not represented at all; the New Jersey delegation coming chiefly from Rutgers and Stevens. The central western States showed up handsomely, and twelve southern States sent from one to four men each; while from the States and Territories west of the Missouri River there was no representation at all, except three from California.

Geographically, therefore, the scientists who attended the meeting are not evenly distributed. New York State sent far more than its quota, even after deducting the attendance from Rochester, the place of meeting. In proportion to its population, Ohio sent twice as many as Pennsylvania, although its average distance from Rochester is greater.

The programme for the third day of the meeting (Friday) contained a list of 146 members that had been elected since the Washington meeting, with symbols expressing their affiliations with the different sections. The majority of these new members specified their intention of joining one section only, but many named two sections, and some three. Twelve members did not specify any section. The following shows the apportionment of these new members among the sections:—

Section A, Mathematics and Astronomy,	14
" B, Physics,	15
" C, Chemistry,	21
" D, Mechanical Science and Engineering,	5
" E, Geology and Geography,	21
" F, Biology,	42
" H, Anthropology,	21
" I, Economic Science and Statistics,	23
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Totals, including duplications,	162

The several branches of science are therefore far from being equally represented in the new membership. The branch of mechanical and engineering science, which in the country at large is developing by leaps and bounds, sends to the association only one-fourth as many members as chemistry and one-eighth as many as biology. The latter sends more new members than the three ap-